

Victoria Junior College
2017 VJC H1 Chemistry Prelim Exam 8872/2
Suggested Answers

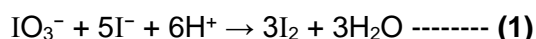
Section A

Answer **all** the questions in this section in the spaces provided.

- S1** An experiment was conducted to determine the amount of ascorbic acid (vitamin C, $C_6H_8O_6$) in a supplement tablet.

A supplement tablet was dissolved in water and made up to 250 cm^3 . 25.0 cm^3 of the solution was pipetted into a conical flask containing 5.0 cm^3 of 0.400 mol dm^{-3} KI and 5.0 cm^3 of 1 mol dm^{-3} HCl. A few drops of starch indicator were then added. This resulting solution was titrated against $4.00 \times 10^{-3}\text{ mol dm}^{-3}$ KIO_3 . 23.90 cm^3 of KIO_3 was required for complete reaction.

When IO_3^- ions are added to an acidic solution containing I^- ions, a redox reaction occurs.



The I_2 formed by this reaction then reacts with ascorbic acid to form dehydroascorbic acid ($C_6H_6O_6$).



Due to reaction (2), the I_2 formed in (1) will immediately react away as long as there is any ascorbic acid present. Once all the ascorbic acid has been reacted, the excess I_2 is free to react with the starch indicator, forming the blue-black starch-iodine complex, indicating the end-point of the reaction.

- (a) Suggest a reason why the concentration of KI used was much higher than that of KIO_3 .

IO_3^- needs to be added in excess, to ensure that there will be sufficient I_2 produced to react with $C_6H_8O_6$.

[1]

- (b) Explain in terms of the change in oxidation number which species have been reduced in (1). Write a half equation for this reduction.

Oxidation number of I changed from +5 in IO_3^- to 0 in I_2 . Hence IO_3^- is reduced.
 $IO_3^- + 6H^+ + 5e^- \rightarrow \frac{1}{2} I_2 + 3H_2O$

[2]

- (c) (i) Calculate the amount, in moles, of ascorbic acid present in the original 250 cm^3 solution.

No. of moles of $IO_3^- = 23.90 \times 10^{-3} \times 4.00 \times 10^{-3} = 9.56 \times 10^{-5}\text{ mol}$
No. of moles of $I_2 = 9.56 \times 10^{-5} \times 3 = 2.87 \times 10^{-4}\text{ mol}$
No. of moles of $C_6H_8O_6$ in $25.0\text{ cm}^3 = 2.87 \times 10^{-4}\text{ mol}$
No. of moles of $C_6H_8O_6$ in $250\text{ cm}^3 = 2.87 \times 10^{-4}\text{ mol} \times 250/25.0$
 $= 2.87 \times 10^{-3}\text{ mol}$

[3]

- (ii) Hence, calculate the mass of ascorbic acid in one tablet.

$$M_r \text{ of } C_6H_8O_6 = 12.0 \times 6 + 1.0 \times 8 + 16.0 \times 6 = 176.0$$

$$\text{Mass of } C_6H_8O_6 \text{ in one tablet} = 2.87 \times 10^{-3} \times 176.0 = 0.505 \text{ g}$$

[2]

- (d) Ascorbic acid is susceptible to oxidation by atmospheric oxygen over time. A student used a sample of ascorbic acid that was prepared several hours prior to titration.

State, with reasoning, what effect this will have on the volume of KIO_3 required for complete reaction and hence the calculated mass of ascorbic acid.

Amount of ascorbic acid in the sample would be lower, less I_2 and hence less KIO_3 would be required for complete reaction. Since mass is proportional to mole, the calculated mass of ascorbic acid would be lower.

[2]

[Total: 10]

- 2 (a) The compound whose bonding most resembles pure ionic bonding is a Group 1 fluoride, MF.

- (i) When the Group 1 cation is passed through an electric field, it is deflected through an angle of $+5.0^\circ$.

Given that the same electric field deflected $^{92}\text{Sr}^{3+}$ through an angle of $+22^\circ$, calculate the relative atomic mass (A_r) of **M**. Hence suggest a possible identity of the **M**.

$$\text{deflection angle} = k |\text{charge/mass}|$$

$$\begin{aligned} \text{For proton,} \\ 22 &= k |3/92| \\ k &= 675 \end{aligned}$$

For unknown Group 1 cation,

$$\begin{aligned} 5.0 &= 675 |1/A_r| \\ A_r &= 135.0 \end{aligned}$$

Hence the Group 1 metal is likely to be caesium.

[2]

- (ii) Explain why the second ionisation energy of **M** is more endothermic than its first ionisation energy.

The second electron is removed from an inner shell, which is closer and more strongly attracted to the nucleus. More energy is needed to remove the second electron, and second ionisation energy is more endothermic.

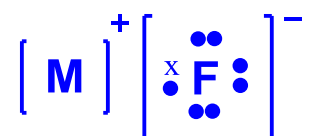
[1]

- (iii) Suggest a reason why the bonding in **MF** resembles pure ionic the most.

Largest possible electronegativity difference between the 2 elements.
[OR Lowest polarising power of cation and lowest polarisability of anion.]

[1]

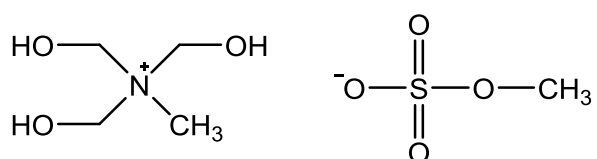
- (iv) Draw a dot-cross diagram to show the bonding in **MF**. Show outer electrons only.



[1]

- (b) Most ionic compounds are solids at room temperature and pressure. However, researchers have designed ionic compounds whose ionic bonding is so weak that they exist as liquids under these conditions.

An example of an ionic liquid is shown below.



Suggest two features of these ions that account for the compound having a low melting point.

1. Small cationic and anionic charges
2. Large cationic and anionic radii

[2]

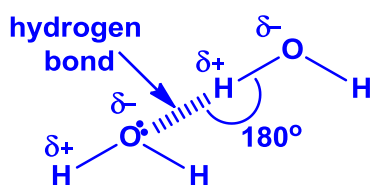
- (c) Hydrogen bonds are weaker than ionic or covalent bonds, but accounts for many important intermolecular attractions.

State an anomalous property of water that is the result of hydrogen bonding.

Ice is less dense than liquid water.
[OR H_2O has a higher boiling point than H_2S .]

[1]

- (d) Draw and label the hydrogen bond between two water molecules. Indicate the bond angle around the hydrogen atom involved in the hydrogen bond. Include all relevant lone pairs and dipoles.



Correct attractive forces between lone pair of O & $\delta^+\text{H}$ on adjacent molecules
 Correct label of hydrogen bond
 Correct label of dipoles
 Correct bond angle

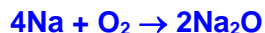
[2]

[Total: 10]

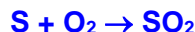
- Q3 (a)** Sodium and sulfur are elements in Period 3 in the Periodic Table.

Describe what you would observe when these two elements are separately burned in oxygen. Write equations for the reactions that occur.

Sodium burns vigorously with a bright yellow / orange flame to form a white solid of Na_2O .



Sulfur burns slowly with a pale blue flame to form a colourless gas of SO_2 in limited oxygen and a colourless gas of SO_3 in excess oxygen.



[4]

- (b)** The oxides, MgO , Al_2O_3 and P_4O_{10} , exist as white powdered solids with high melting points.

- (i)** Arrange the oxides in decreasing melting points and explain their relative melting points in terms of their structure and bonding.

Melting points decrease in the order: $\text{MgO} > \text{Al}_2\text{O}_3 > \text{P}_4\text{O}_{10}$

Both MgO and Al_2O_3 have giant ionic structure with strong electrostatic attraction between the cations and anions.

As Al^{3+} has a higher charge density and hence higher polarising power than Mg^{2+} , the O^{2-} electron cloud experiences distortion by the highly polarising Al^{3+} . This results in a decrease in ionic character and a lower lattice energy in Al_2O_3 and hence a lower melting point.

P_4O_{10} has a simple molecular structure with weak instantaneous dipole-induced dipole interactions between the molecules. A small amount of energy is needed to break these weak interactions, hence lowest melting point.

[4]

- (ii)** Describe two chemical reactions you could carry out on a sample of white powder to determine the identity of the oxide.

Add $\text{HCl}(\text{aq})$ and $\text{NaOH}(\text{aq})$

	MgO	Al_2O_3	P_4O_{10}
Add $\text{HCl}(\text{aq})$	Dissolves to form a colourless solution [of $\text{MgCl}_2(\text{aq})$].	Dissolves to form a colourless solution [of $\text{AlCl}_3(\text{aq})$].	Does not dissolve (negligible dissolution of solid due to solubility of P_4O_{10} in H_2O to give H_3PO_4 is considered).

Add NaOH(aq)	Does not dissolve (negligible dissolution of solid due to some solubility of MgO in H ₂ O to form Mg(OH) ₂ is considered).	Dissolves to form a colourless solution [of NaAl(OH) ₄ (aq)].	Dissolves to form a colourless solution [of Na ₃ PO ₄ (aq)].
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React with both NaOH and HCl, Al₂O₃ identified

React with both NaOH only, P₄O₁₀ identified

React with HCl only, MgO identified

[2]

[Total: 10]

- 4 (a) *Cracking* is a process used in the petroleum industry that converts large hydrocarbon molecules into smaller, more useful ones.

- (i) In one particular reaction, a 16-carbon alkane undergoes cracking to form C_3H_6 , C_4H_8 and C_6H_{14} as the **only** products.

Write a balanced equation to represent this reaction.



[1]

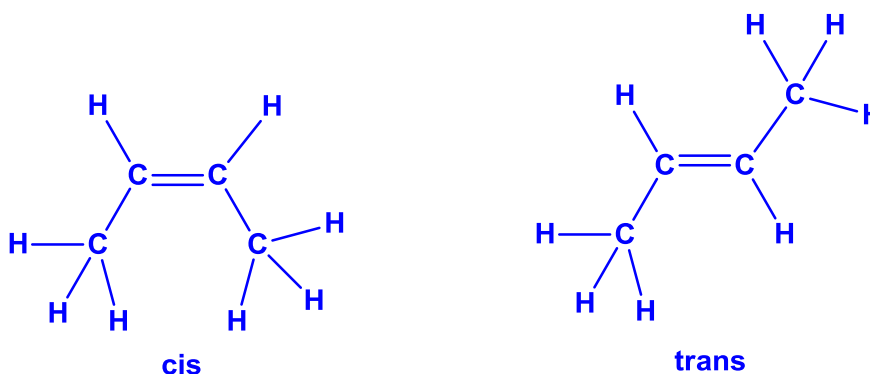
- (ii) The hydrocarbon, C_4H_8 , formed from the above reaction is found to display *cis-trans* isomerism.

State the structural requirements for *cis-trans* isomerism to be displayed in an organic molecule.

The molecule must have a $C=C$ bond which cannot be rotated.
To each alkene carbon, 2 different groups are attached.

[2]

- (iii) Hence, draw the displayed formulae of the *cis-trans* isomers of C_4H_8 . Label each isomer clearly.

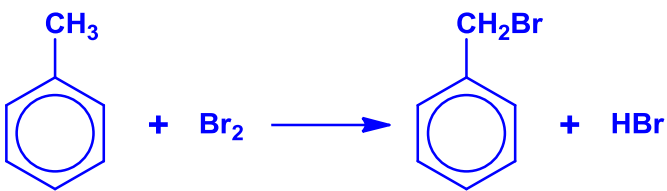
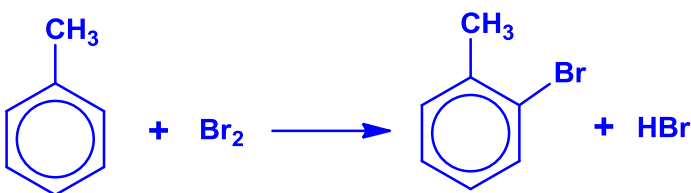


[2]

- (b) Another important process in the petroleum industry is *reforming*, which increases the proportion of aromatic, cyclic and branched-chain hydrocarbons in petrol. This enables petrol to burn more smoothly in car engines.

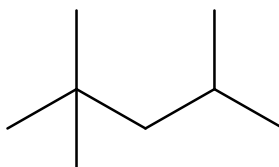
- (i) One of the main products formed from the reforming process is methylbenzene, which undergoes two different reactions with bromine, depending on the conditions used.

For each reaction, state the conditions required and write a balanced equation, showing clearly the structure of **any one mono-brominated** organic product formed.

Conditions	Equation
UV light, excess $\text{C}_6\text{H}_5\text{CH}_3$	
Presence of anhydrous FeBr_3 catalyst	 [OR show Br at position 4]

[2]

- (ii) Another product of the reforming process has the structure below:



State the name of the compound above.

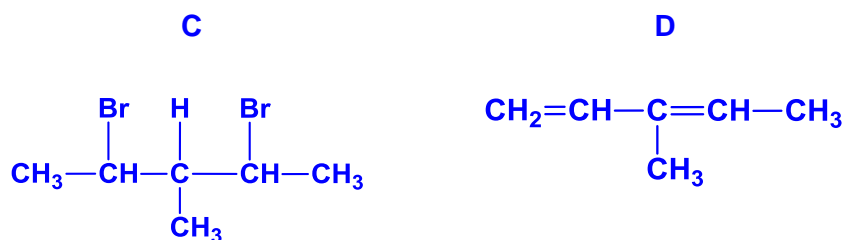
2, 2, 4–trimethylpentane

[1]

- (c) Compound **C** has a symmetrical structure with the molecular formula $\text{C}_6\text{H}_{12}\text{Br}_2$. In the presence of alcoholic NaOH , **C** produces **D**, C_6H_{10} .

When **D** is oxidised by hot acidified KMnO_4 , three compounds, CO_2 , $\text{CH}_3\text{CO}_2\text{H}$ and $\text{CH}_3\text{COCO}_2\text{H}$, are formed in equimolar amounts.

Deduce the structures of **C** and **D**.



[2]

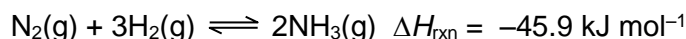
[Total: 10]

Section B

Answer **two** questions from this section on separate answer papers.

- 5 (a) Nitrogen is an element that is essential to life on earth. In spite of nitrogen's abundance in the atmosphere, the quantity of nitrogen containing compounds that were available for human use was limited. The Haber process for the manufacture of ammonia and the Ostwald process for the conversion of ammonia to nitric acid were developed in the early 20th century.

Ammonia is manufactured from nitrogen and hydrogen by the Haber process as shown in the equation:



- (i) Write an expression for the equilibrium constant, K_c , for the Haber process.

$$K_c = \frac{[\text{NH}_3]^2}{[\text{N}_2][\text{H}_2]^3}$$

[1]

- (ii) Calculate the value of K_c given the following equilibrium concentrations at 1000 K. State the units of K_c .

gas	concentration/ mol dm ⁻³
nitrogen	1.36
hydrogen	1.84
ammonia	0.142

$$K_c = \frac{(0.142)^2}{(0.136)(1.84)^3} \\ = 2.38 \times 10^{-3} \text{ mol}^{-2} \text{ dm}^6$$

[2]

- (iii) Explain why the activation energy of the process is high.

The activation energy of the process is high due to the high bond energy of the N≡N bond.

[1]

- (iv) Hence describe and explain the conditions required for the favourable production of ammonia in Haber process.

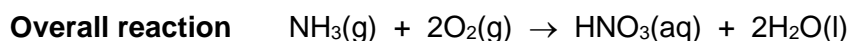
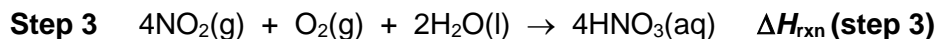
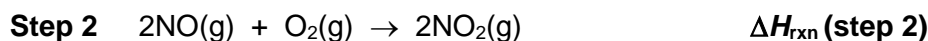
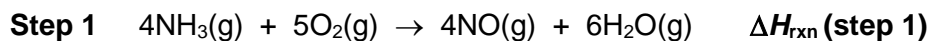
High pressure (200 atm) favors the production of ammonia. By Le Chatelier's Principle, the equilibrium position will shift right to reduce the increase in pressure leading to greater amount of ammonia.

Low temperature favors the production of ammonia. By Le Chatelier's Principle, the equilibrium position will shift right to produce more heat leading to greater amount of ammonia. However low temperature will mean slower rate of reaction. Hence temperature is kept high (450 °C) for faster rate of reaction.

Addition of catalyst (finely divided iron) is used to increase the rate of reaction but not the yield of ammonia.

[3]

- (b) A large proportion of the ammonia manufactured is then used to manufacture nitric acid which is another industrially important compound. In Ostwald process, nitric acid is produced industrially from ammonia, air and water using the following sequence of reactions:



- (i) Using relevant bond energy data from the *Data Booklet* and the following value, calculate the enthalpy change, ΔH_{rxn} (step 1), for the reaction between ammonia and oxygen gas.

Bond energy for $\text{NO}(\text{g}) = 607 \text{ kJ mol}^{-1}$

$$\begin{aligned}\Delta H_{\text{rxn}}(\text{step 1}) &= \Sigma(\text{BE of reactants}) - \Sigma(\text{BE of products}) \\ &= [12(390) + 5(496)] - [4(607) + 12(460)] \\ &= -788 \text{ kJ mol}^{-1}\end{aligned}$$

[2]

- (ii) Using the following enthalpy changes, calculate the enthalpy change, ΔH_{rxn} (step 2) and ΔH_{rxn} (step 3).

$$\begin{aligned}\Delta H_f(\text{NO}_2) &= +33.2 \text{ kJ mol}^{-1} \\ \Delta H_f(\text{NO}) &= +90.3 \text{ kJ mol}^{-1} \\ \Delta H_f(\text{HNO}_3) &= -207.4 \text{ kJ mol}^{-1} \\ \Delta H_c(\text{H}_2) &= -285.8 \text{ kJ mol}^{-1}\end{aligned}$$

$$\begin{aligned}\Delta H_{\text{rxn}}(\text{step 2}) &= \Sigma(\Delta H_f \text{ products}) - \Sigma(\Delta H_f \text{ reactants}) \\ &= (33.2) - 2(90.3) \\ &= -114 \text{ kJ mol}^{-1}\end{aligned}$$

$$\begin{aligned}\Delta H_{\text{rxn}}(\text{step 3}) &= \Sigma(\Delta H_f \text{ products}) - \Sigma(\Delta H_f \text{ reactants}) \\ &= [4(-207.4)] - [4(+33.2) + 1(0) + 2(-285.8)] \\ &= -391 \text{ kJ mol}^{-1}\end{aligned}$$

[3]

- (iii) Hence, or otherwise, calculate the enthalpy change for the **overall reaction**.

$$\begin{aligned}&\text{Adding Step 1, Step 2 x 2 and Step 3 gives} \\ &4\text{NH}_3(\text{g}) + 8\text{O}_2(\text{g}) \rightarrow 4\text{HNO}_3(\text{aq}) + 8\text{H}_2\text{O}(\text{l}) \\ &\text{Dividing by 4 will give:} \\ &\text{NH}_3(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{HNO}_3(\text{aq}) + 2\text{H}_2\text{O}(\text{l}) \\ &4 \times \Delta H_{\text{rxn}}(\text{overall}) = -788 + 2(-114) + (-391) \\ &\Delta H_{\text{rxn}}(\text{overall}) = -352 \text{ kJ mol}^{-1}\end{aligned}$$

[2]

(c) A monobasic acid **HA**, extracted from a fruit has a pH of 3.5.

(i) Calculate the concentration, in mol dm⁻³, of hydrogen ions in the acid **HA**.

$$[\text{H}^+] = 10^{-3.5} = 3.16 \times 10^{-4} \text{ mol dm}^{-3}$$

[1]

(ii) 25.0 cm³ of a sample of the acid **HA** was titrated with 0.25 mol dm⁻³ aqueous NaOH. 21.25 cm³ of the aqueous NaOH was required to reach equivalence point.

Calculate the concentration, in mol dm⁻³, of the acid **HA**.

$$\begin{aligned} \text{No. of mol of NaOH} &= \frac{21.25}{1000} \times 0.25 = 5.312 \times 10^{-3} \\ &= \text{No. of mol of HA} \end{aligned}$$

$$[\text{HA}] = \frac{5.312 \times 10^{-3}}{\frac{25}{1000}} = 0.2125 = 0.213 \text{ mol dm}^{-3}$$

[2]

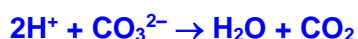
(iii) Based on your answers to (c)(i) and (c)(ii) above, what can you deduce about the strength of the acid **HA**? Give a reason for your deduction.

HA is a weak acid.

Since $[\text{HA}] \gg [\text{H}^+]$, **HA dissociates partially to form H⁺.**

[1]

(iv) Hence predict the volume of carbon dioxide evolved when 25.0 cm³ of 0.40 mol dm⁻³ of HCl and **HA** reacts with excess Na₂CO₃ under standard conditions.



$$\begin{aligned} \text{Number of moles of CO}_2 &= \frac{1}{2} \times \text{number of moles of H}^+ \\ &= \frac{1}{2} \times (0.40 \times 0.025) \\ &= 5.00 \times 10^{-3} \end{aligned}$$

$$\begin{aligned} \text{Volume of CO}_2 \text{ evolved for HCl} &= 5.00 \times 10^{-3} \times 24000 \\ &= 120 \text{ cm}^3 \end{aligned}$$

Since volume and conc. used for HA is the same,

$$\text{Volume of CO}_2 \text{ evolved for HA} = 120 \text{ cm}^3$$

Alternative answer



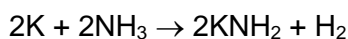
$$\begin{aligned} \text{Number of moles of HCl} &= \text{number of moles of HA} \\ &= \text{number of moles of CO}_2 \\ &= (0.40 \times 0.025) \\ &= 1.00 \times 10^{-2} \end{aligned}$$

$$\begin{aligned} \text{Volume of CO}_2 \text{ evolved (in total)} &= 1.00 \times 10^{-2} \times 24000 \\ &= 240 \text{ cm}^3 \end{aligned}$$

[2]

[Total: 20]

- 6 (a) Potassium reacts with ammonia to give a compound of KNH_2 as shown in the given equation:

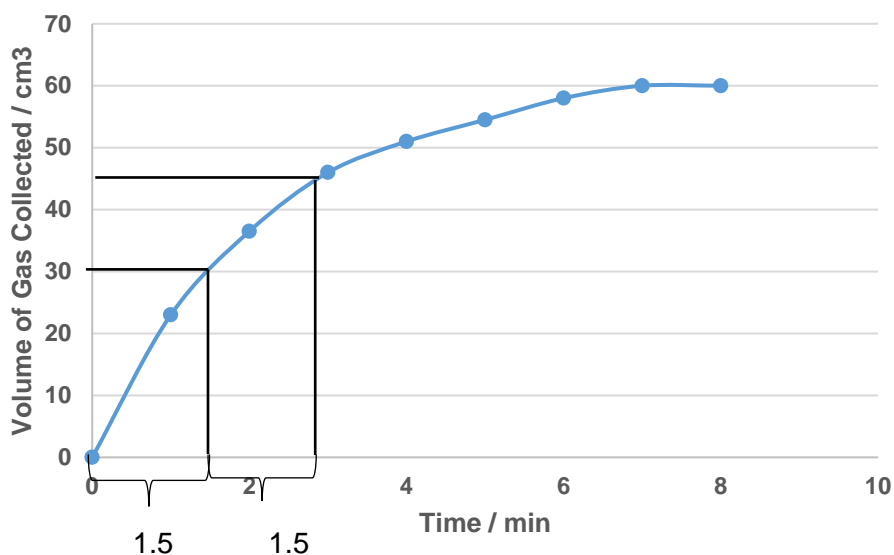


The rate of the reaction was investigated by using a freshly cut piece of potassium which was weighed and added to a large excess of ammonia. The experiment was conducted at room temperature and pressure.

The total volume of gas evolved at every minute was recorded and shown below.

Time / min	0	1	2	3	4	5	6	7	8
Total volume of gas / cm^3	0	23.0	36.5	46.0	51.0	55	58.0	60	60

- (i) Plot the experimental results on graph paper.



Axes and units

Smooth curve

Graph more than $\frac{1}{2}$ page

Construction lines to show 2 constant half-lives

[2]

- (ii) Hence deduce the order of reaction with respect to potassium.

Since half-life is constant at 1.5 min, it is first order wrt to potassium.

[1]

- (iii) Write a rate equation for the reaction and calculate the rate constant, stating its units.

Rate = $k[\text{K}]$

$$t_{1/2} = \frac{\ln 2}{k} = 1.5 \text{ hence } k = \frac{\ln 2}{1.5} = \frac{0.693}{1.5} = 0.462 \text{ min}^{-1}$$

[2]

- (iv) In this experiment, the kinetics appear to be zero order with respect to ammonia. Suggest a reason for this.

The ammonia was in large excess hence its change in concentration will not be significant.

[1]

- (v) Calculate the mass of potassium used in the experiment.

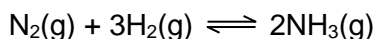
Amount of hydrogen evolved = $60 / 24000 = 2.50 \times 10^{-5}$ mol

Amount of potassium used = $2 \times 2.50 \times 10^{-5} = 5.00 \times 10^{-5}$ mol

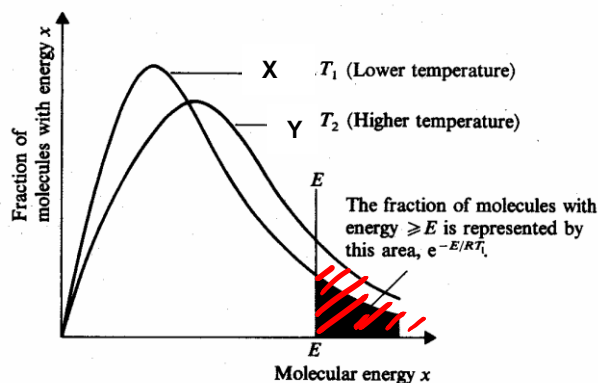
Mass of potassium = $5.00 \times 10^{-5} \times 39.1 = 0.196$ g

[2]

- (b) Ammonia is an important starting material in the manufacture of fertilisers as well as explosives and plastics. The Haber process is used to form ammonia as shown in the equation below:



- (i) Draw a Maxwell Boltzmann distribution curve for the reactants at temperature T_1 . Label this curve **X**. Mark the position of the activation energy with a line. Label this as E_a .



Axes labelled correctly
Start from 0 and correct shape
Indicate E_a
Shade area under curve

[2]

- (ii) On the axes that you have drawn, draw a **second** distribution curve that represents the reaction at a higher temperature T_2 . Label this curve **Y**.

Use curves **X** and **Y** to describe and explain the effects of an increase in temperature on the rate of a reaction.

Correct shape and position of new curve.
When temperature increases, average kinetic energy of the molecules increases. Proportion of molecules with minimum E_a also increases. Hence frequency of effective collisions increases leading to an increase in rate.

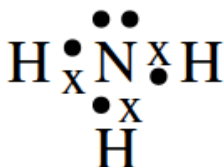
[3]

- (iii) Name a catalyst that can be used for the Haber Process.

Iron [OR aluminium oxide]

[1]

- (c) (i) Draw a dot-and-cross diagram to show the bonding in an ammonia molecule.



[1]

- (ii) By using the Valence Shell Electron Pair Repulsion theory, state the shape and bond angle in the ammonia molecule and explain in details how it arises.

107° and trigonal pyramidal in shape

Presence of 3 bond pairs and 1 lone pair electrons

Degree of repulsion according to VSEPR theory is lone pair–lone pair > lone pair–bond pair > bond pair–bond pair

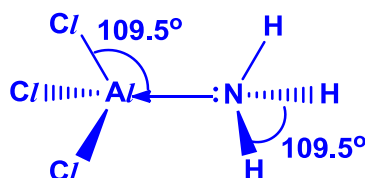
The electron pairs will maximise their distance apart in order to minimise repulsion hence lone pair pushes 3 bond pairs closer together.

[2]

- (iii) When ammonia is mixed with aluminium chloride in a 1:1 ratio, a new single compound is formed.

Suggest the type of bond that is formed between ammonia and aluminium chloride, explaining your answer clearly. Draw a **displayed** structure of the product formed, indicating the bond angle with respect to nitrogen and aluminium.

Dative bond is formed when lone pair of electrons on nitrogen of ammonia is shared with the electron-deficient aluminium atom which has energetically accessible empty orbitals.

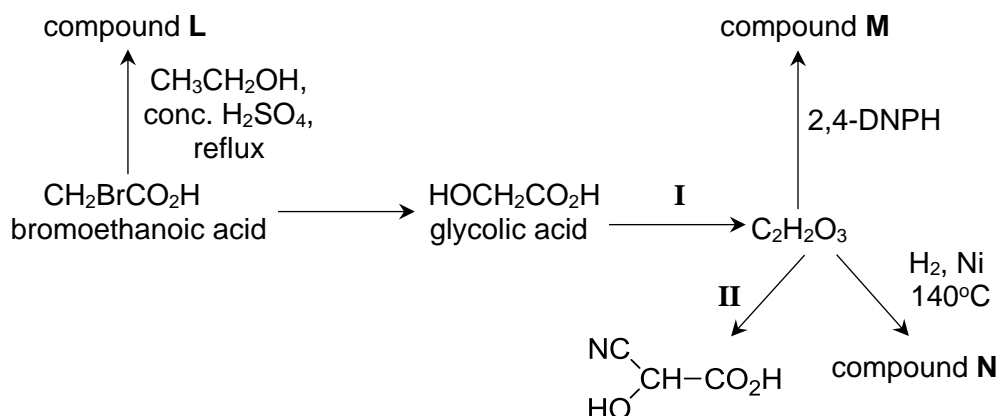


[3]

[Total: 20]

- 7 (a) Glycolic acid, $\text{HOCH}_2\text{CO}_2\text{H}$, is a colourless, odourless and hygroscopic crystalline solid which is used in various skin-care products.

The reaction scheme below shows some reactions involving glycolic acid.



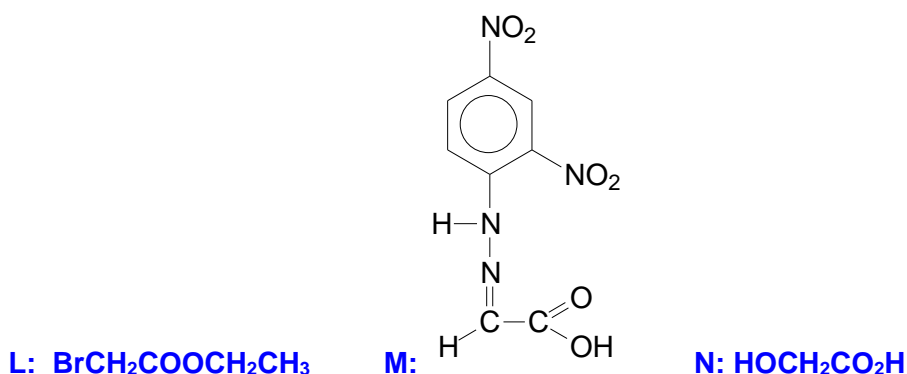
- (i) State the reagents and conditions for reactions I and II.

Reaction I: $\text{K}_2\text{Cr}_2\text{O}_7(\text{aq})$, $\text{H}_2\text{SO}_4(\text{aq})$, distil

Reaction II: HCN , NaCN (catalyst), room temperature

[2]

- (ii) Draw the structural formulae for compounds L, M and N.



for each correct structure

[3]

- (iii) The K_a of bromoethanoic acid is $1.38 \times 10^{-3} \text{ mol dm}^{-3}$.

Predict, with reasons, whether the K_a of chloroethanoic acid would be greater or less than that of bromoethanoic acid.

The electron-withdrawing inductive effect of chlorine is greater than that of bromine due to its higher electronegativity. Hence, this leads to a greater extent of dispersal of negative charge in carboxylate ion, making the anion more stable.

Hence, chloroethanoic acid would be a stronger acid. Its K_a value will therefore be greater than $1.38 \times 10^{-3} \text{ mol dm}^{-3}$.

[3]

- (b) Bromoethane is used as a solvent, an anaesthetic in medicine and a refrigerant. It is also a useful intermediate for making other organic compounds, such as carboxylic acid.

- (i) Bromoethane reacts with aqueous NaOH under heating condition.

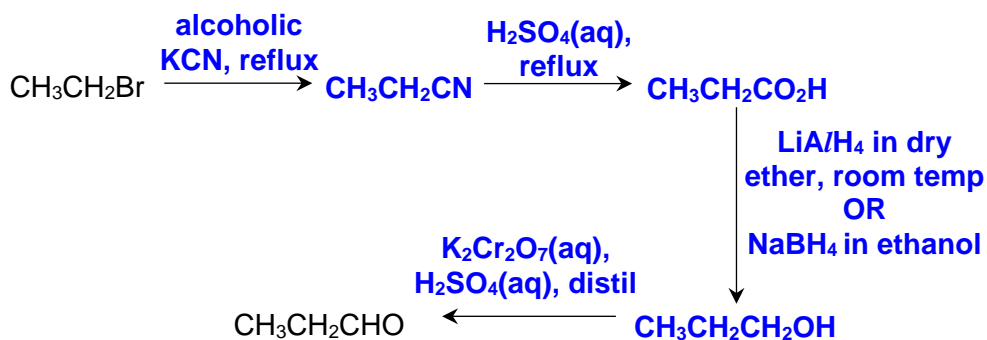
How would you expect the rate of this reaction to compare to that of the reaction of iodoethane with aqueous NaOH? Explain your answer.

2-iodobutane will have a faster reaction with NaOH(aq). I has a larger atomic radius than Cl, hence, C-I has a longer bond length / weaker bond strength. C-I bond will be broken more easily and 2-iodobutane will therefore undergo substitution more easily.

[3]

- (ii) Bromoethane can be used to prepare propanal under laboratory conditions, using propanoic acid as an intermediate.

Suggest a synthesis involving not more than 4 steps for this conversion. Include reagents and conditions for each step, as well as the structures of the intermediate compounds formed.



[5]

- (c) Propose appropriate test-tube reactions which would enable you to distinguish between the following compounds. Include expected observations for each compound in your answer.

I. bromoethane and iodoethane

Test: Add NaOH(aq), heat, followed by addition of excess HNO₃(aq) and AgNO₃(aq).

Observation: A cream ppt of AgBr is formed for bromoethane, while a yellow ppt of AgI is formed for iodoethane.

[2]

II. CH₃CH₂CO₂CH₃ and CH₃CH₂CO₂CH₂CH₃

Test: Add H₂SO₄ (aq), heat, followed by KMnO₄(aq)

Observation:

For CH₃CH₂CO₂CH₃, there is a decolourisation of purple KMnO₄ and an effervescence of CO₂ which forms white ppt with limewater.

For $\text{CH}_3\text{CH}_2\text{CO}_2\text{CH}_2\text{CH}_3$, there is a decolourisation of purple KMnO_4 without effervescence.

OR

Test: Add NaOH (aq), heat, followed by I_2 (aq), NaOH (aq), warm $< 70^\circ\text{C}$.

Observation:

For $\text{CH}_3\text{CH}_2\text{CO}_2\text{CH}_3$, there is no pale yellow ppt of CHI_3 formed.

For $\text{CH}_3\text{CH}_2\text{CO}_2\text{CH}_2\text{CH}_3$, there is pale yellow ppt CHI_3 formed.

[2]

[Total : 20]